

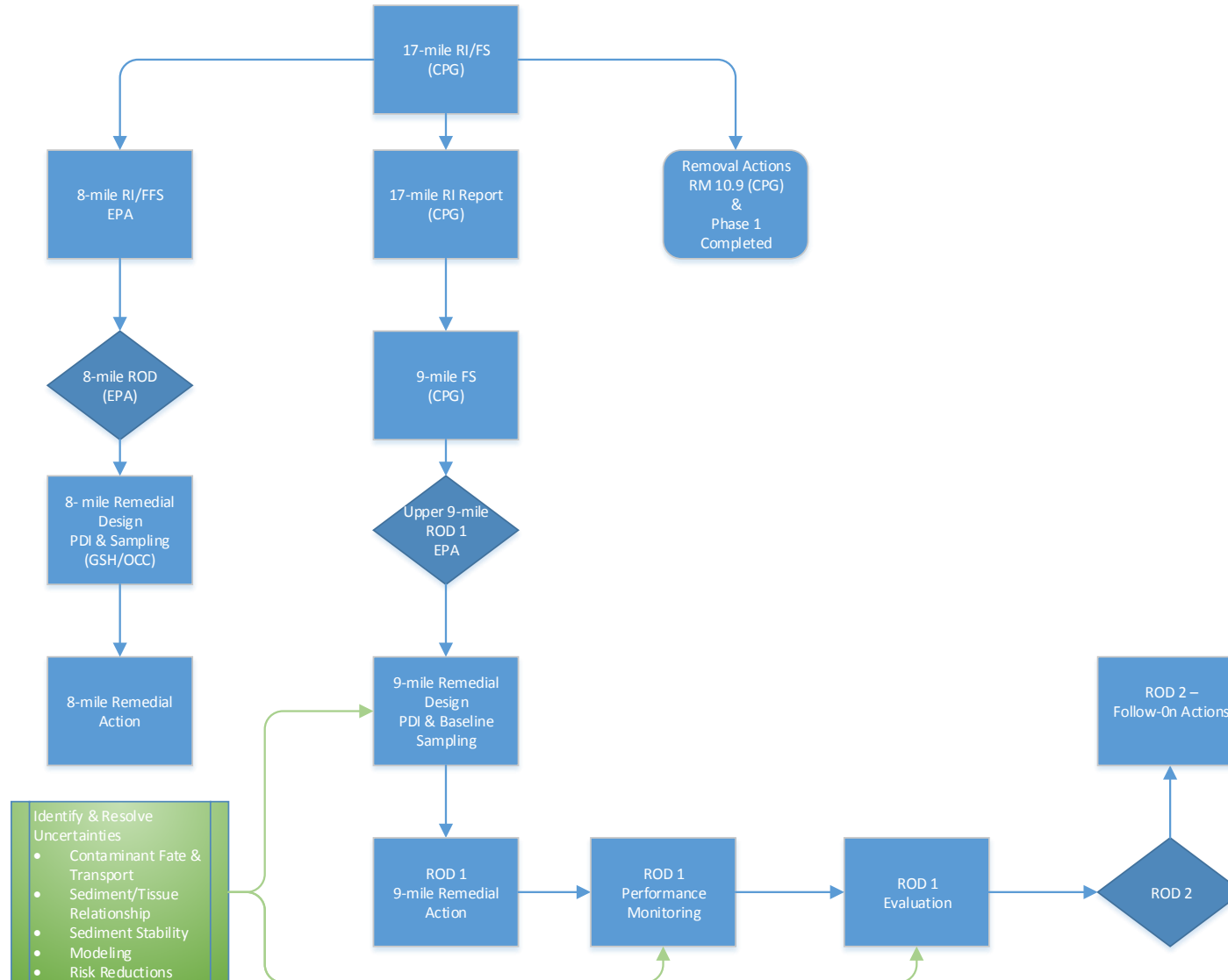
Upper 9-mile Plan

September 11, 2017

Overview

- Upper 9-Mile Plan
 - Adaptive Management for the Upper 9-Miles
- Strategy Behind Phase 1 Proposal
- Recovery Potential of the Phase 1 Remedial Action
- Hypothetical Recovery Conditional Simulation 37 following Phase 1 Remedy
- Remedial Efficiency of 2,3,7,8-TCDD RALs from 500 ppt to 100 ppt
- Role and Use of Modeling in Upper 9-mile Plan
 - Current Limitations of FFS & RI/FS Projections
 - Bioaccumulation Peer Review
- Upper 9-Mile RAOs
- Upper 9-mile Adaptive Management Process
 - Adaptive Management Plan Development
 - Remedial Action Monitoring Elements
 - Anticipated Baseline and Long-Term Monitoring Components
 - Preliminary Metrics, Triggers, and Responses
- General Options for Expanding the Set of Remedial Alternatives
- Preliminary Set of Remedial Alternatives
- Upper 9-Mile Schedule
 - FS Technical Memoranda Schedule
- Next Steps

Upper 9-mile Plan



Adaptive Management for the Upper 9-Mile Plan

- Apply Adaptive Management to Expedite Remedial Action –
 - Use RI CSM to craft a remedial action
 - Establish monitoring and contingencies around uncertain elements of the CSM
 - Move forward with cautious optimism; acknowledging absolute/near certainty of success is not possible
- FS Models Do Not Accurately Predict Long-Term Benefits of Remedial Action
 - Both CPG and EPA models are subject to considerable uncertainty and lack important calibration data
 - We have little understanding of the magnitude of the errors associated with predictions
 - The uncertainty can be greatly reduced after obtaining the PDI data and the resulting greater certainty about the sediment contaminant distribution and the remediation footprint
- Using Adaptive Management to Expedite Remedial Action will -
 - Reduce risks quickly
 - Increase and improve the overall recovery potential of the river and biota
 - Reduce recontamination from Upper 9 miles to Lower 8 miles
 - Provide a strong empirical basis to determine what more to do if Phase 1 is not sufficient

Strategy Behind Phase 1 Proposal

- Remediate source areas by applying RALs of 300 ppt for 2,3,7,8-TCDD and 1 ppm for PCBs
- Allow areas with good recovery potential to respond to the substantial reduction in concentrations achieved by remediating source areas
 - Using natural recovery in these areas achieves a cost-effective remedy that actively addresses risk (~90% reduction by active remediation), minimizes negative consequences of active remediation and harmonizes remedies for the lower 8 miles and the upper 9 miles

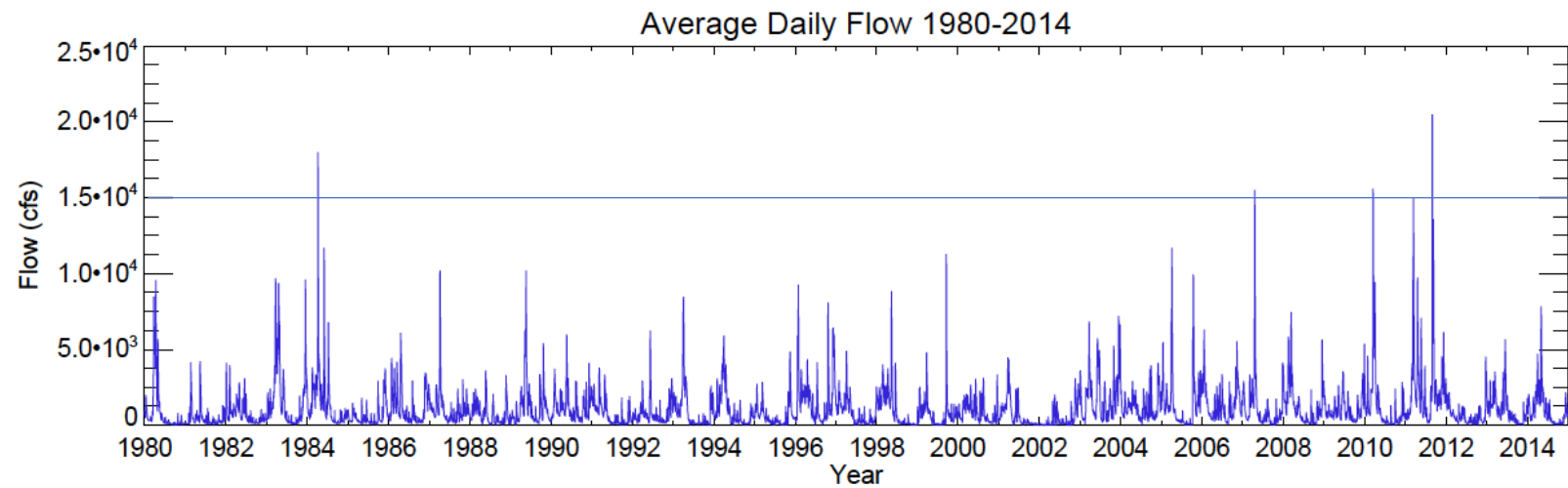
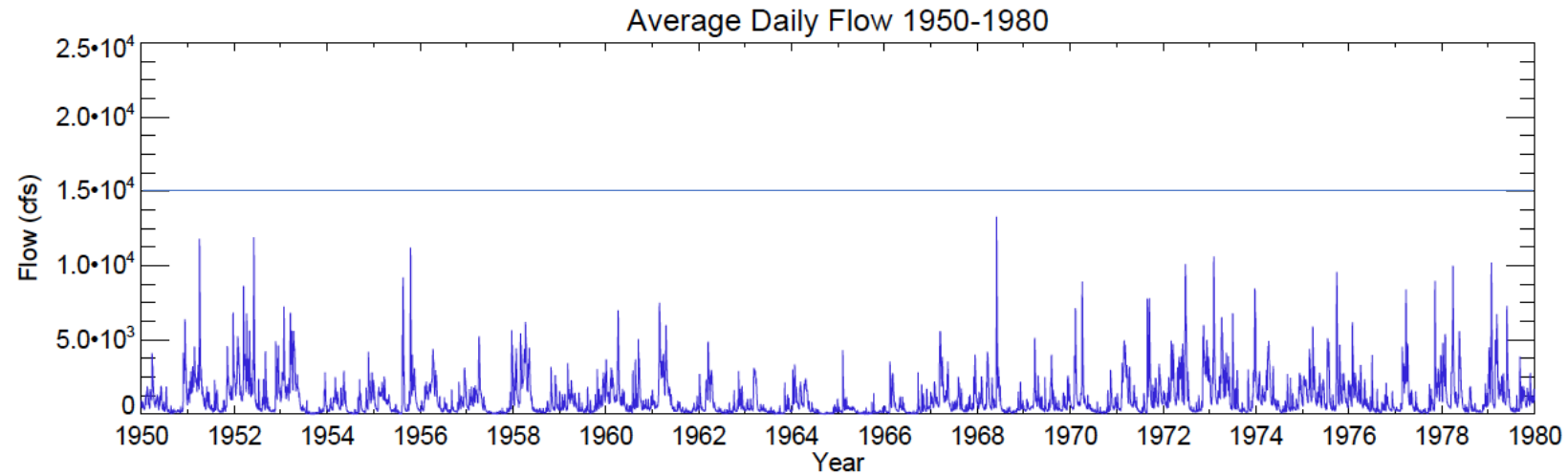
Indication of Recovery Potential at Locations with 2,3,7,8-TCDD of 200 ppt to 300 ppt

- 12 such cores collected between RM 8 and RM 12.5
- Indicators of recovery potential
 - More than one layer with concentrations in the 200 ppt to 400 ppt range indicative of deposition
 - No indication of significant erosion at the location
 - Recognizing that a 90-year event occurred in 2011 (Hurricane Irene)
 - Absence of subsurface contamination – location of temporary deposition

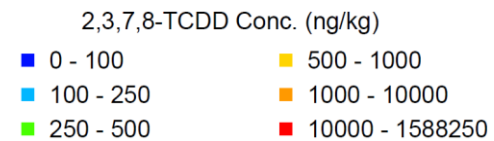
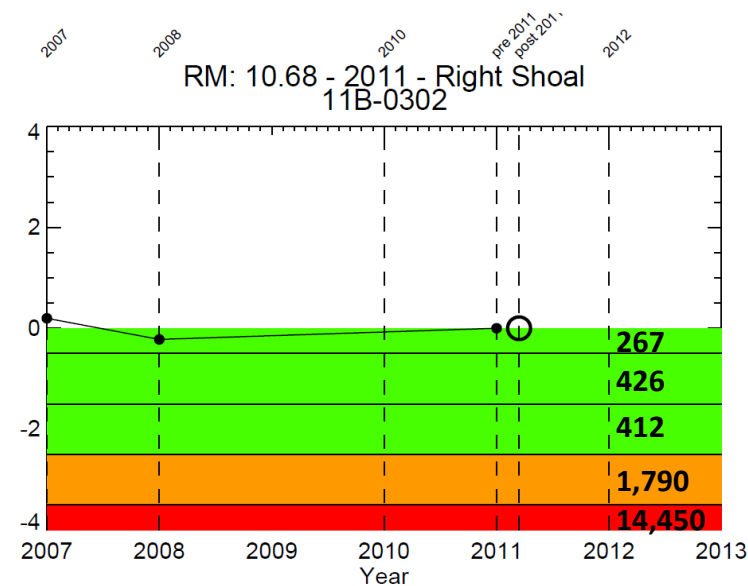
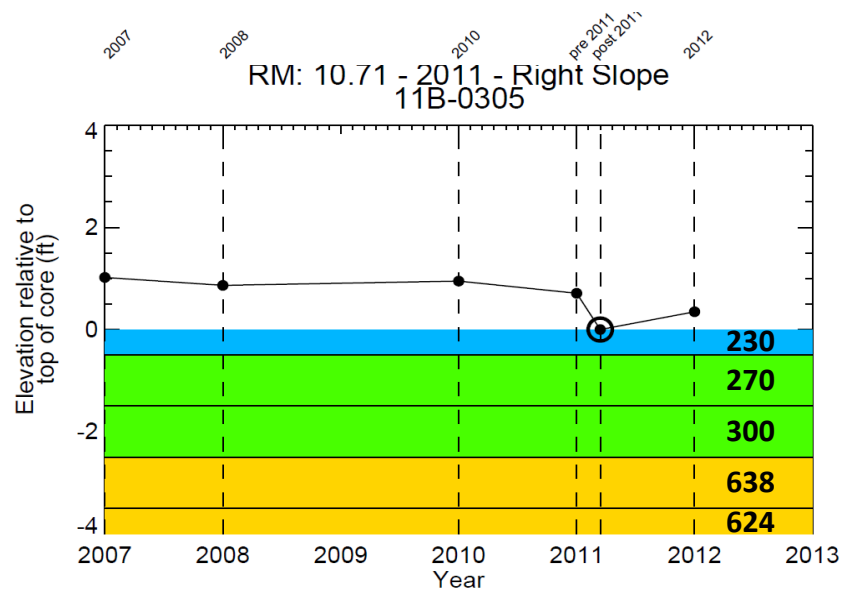
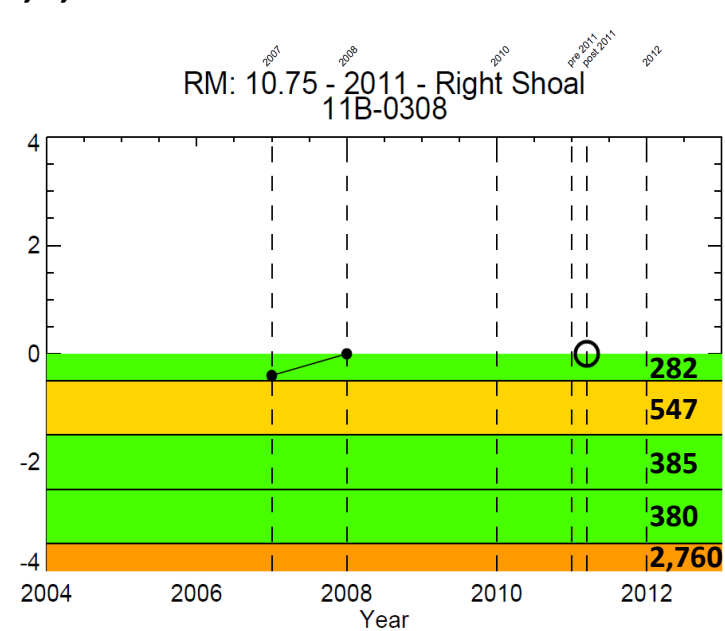
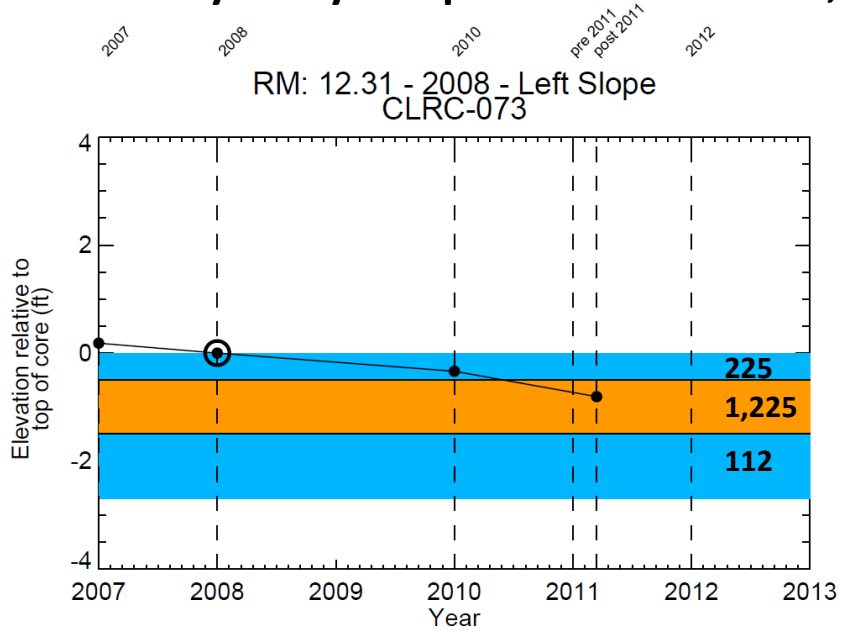
Indication of Recovery Potential at Locations with 2,3,7,8-TCDD of 200 ppt to 300 ppt

- Summary of findings
 - 10 of 12 locations show recovery potential
 - 7 locations have more than one layer with concentrations in the 200 ppt to 400 ppt range
 - 2 locations have higher concentrations below the surface layer but only modest bathy changes despite high flow events
 - 1 location has no subsurface contamination – temporary deposition
 - 2 locations would be remediated in Phase 1 based on vulnerability to erosion
- Recovery despite unusually frequent high-flow events that would tend to mask longer term recovery potential
 - 2007-2011 included 4 events with peak daily avg flow of about 15,000 cfs or more at Little Falls
 - Only one such event in the prior 27 years

Flow Record at Little Falls

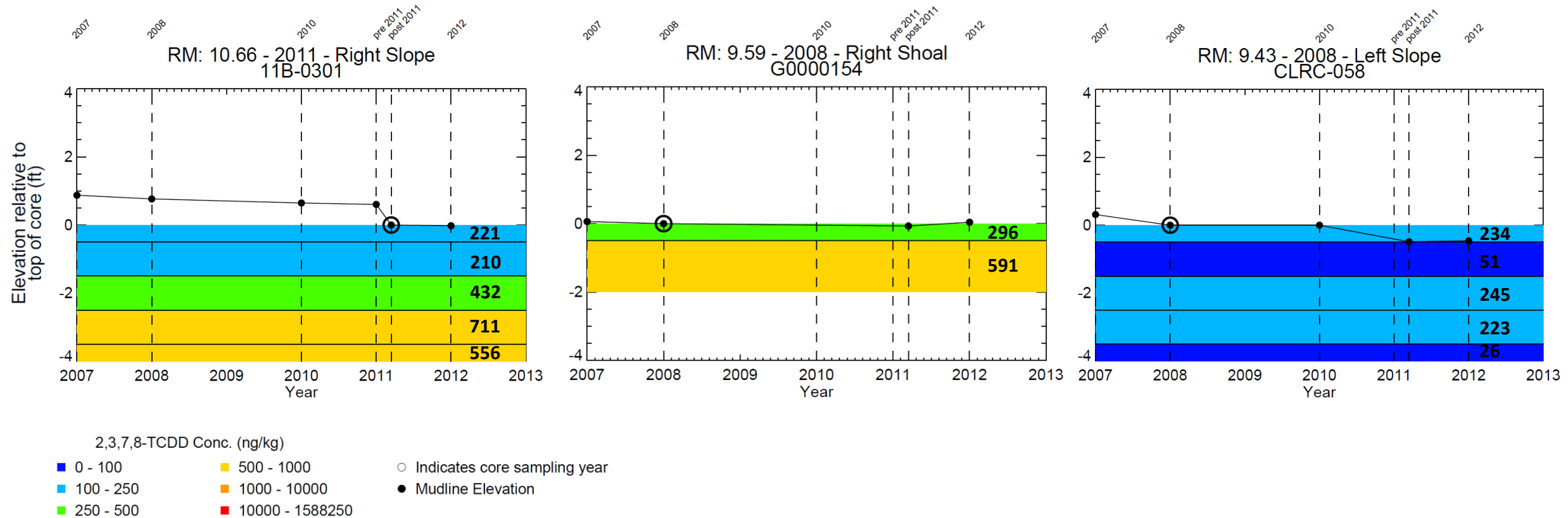


Bathymetry Temporal and Vertical 2,3,7,8-TCDD Profiles for Cores With 200 ppt to 300 ppt in the Top 0.5 ft

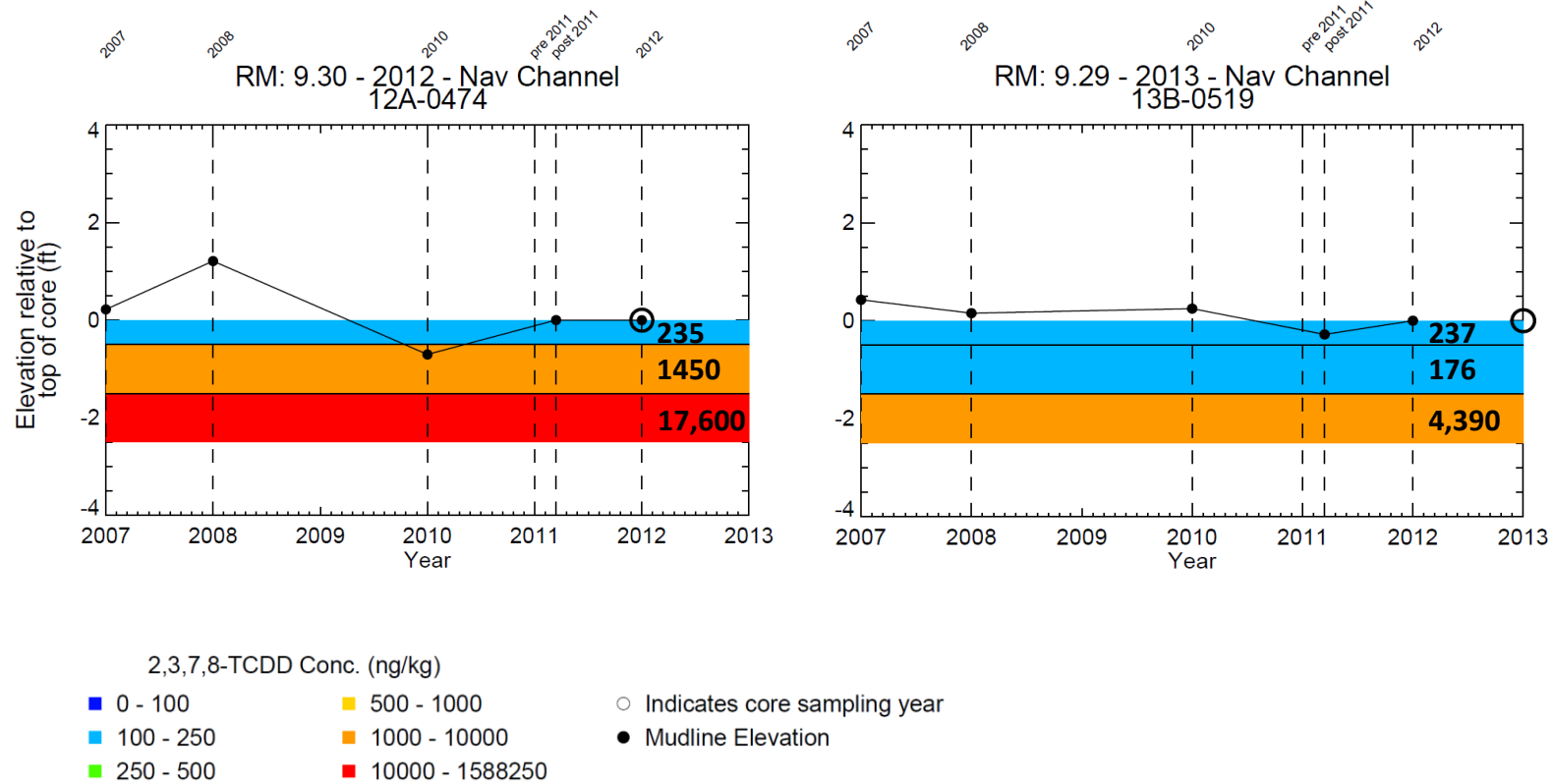


○ Indicates core sampling year
● Mudline Elevation

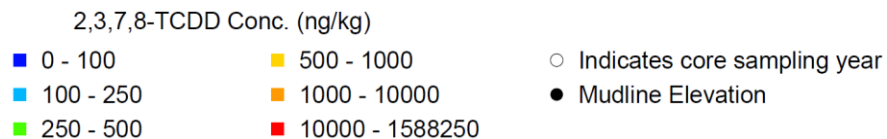
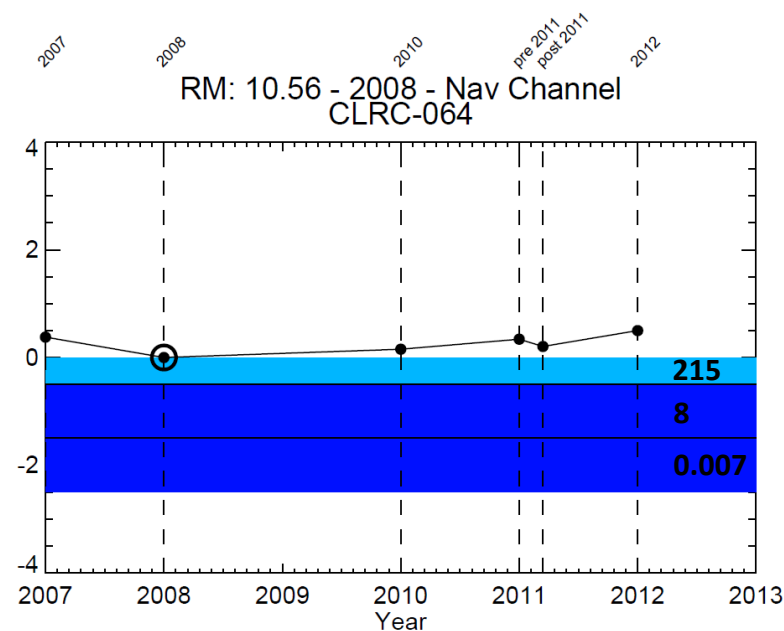
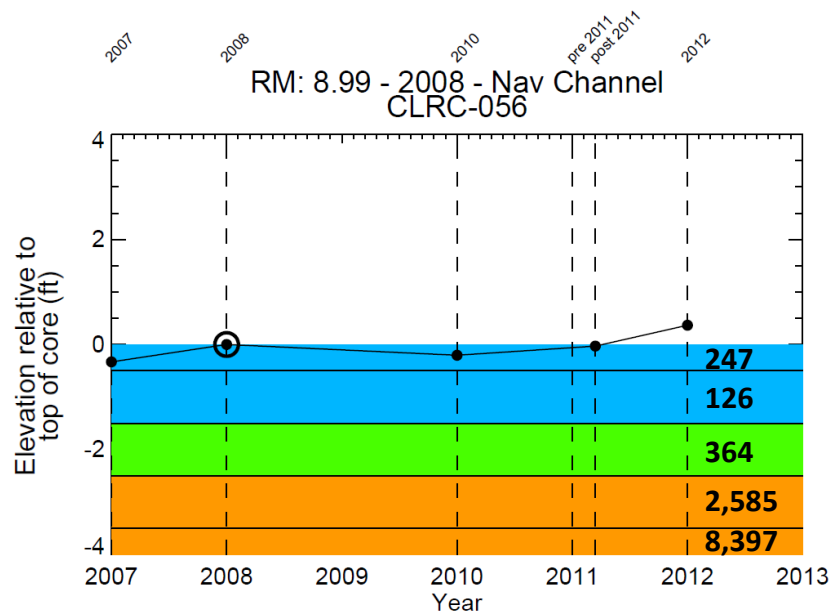
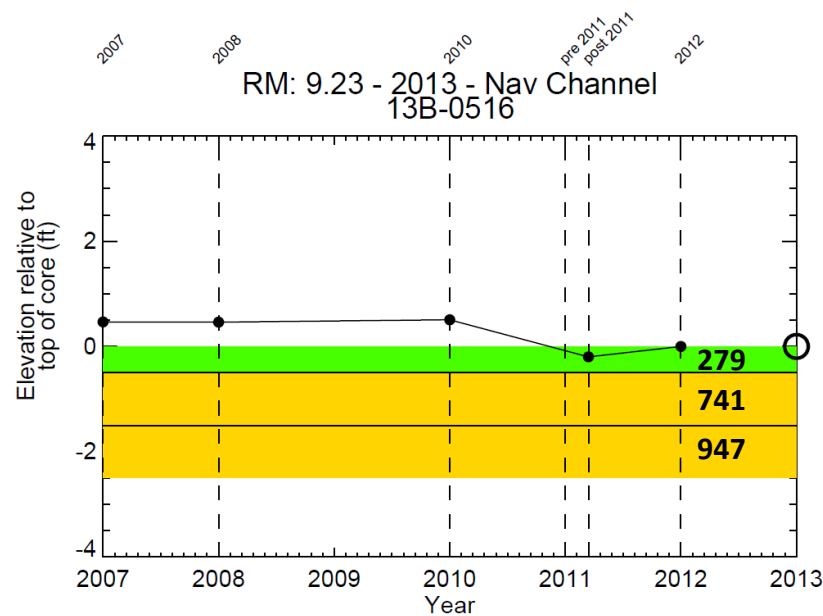
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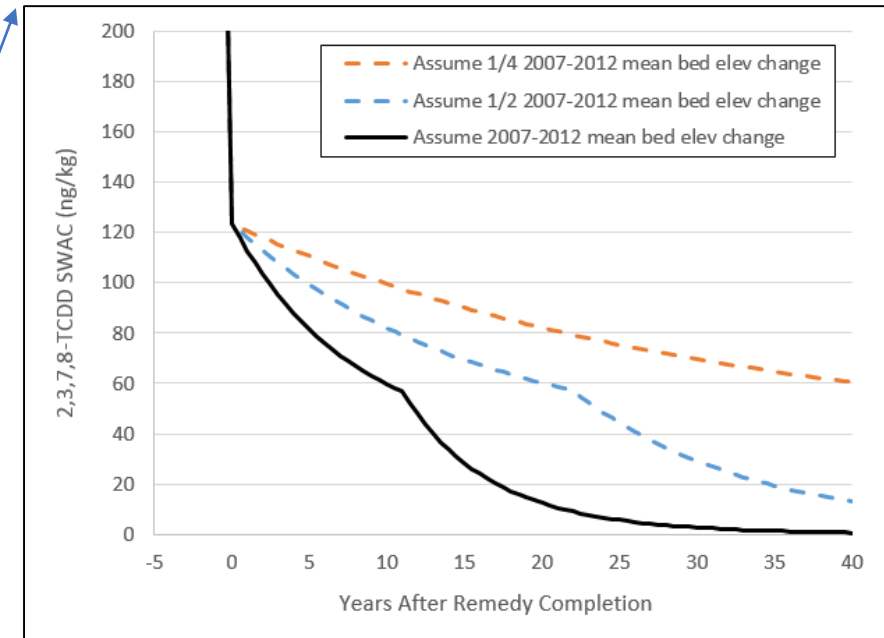
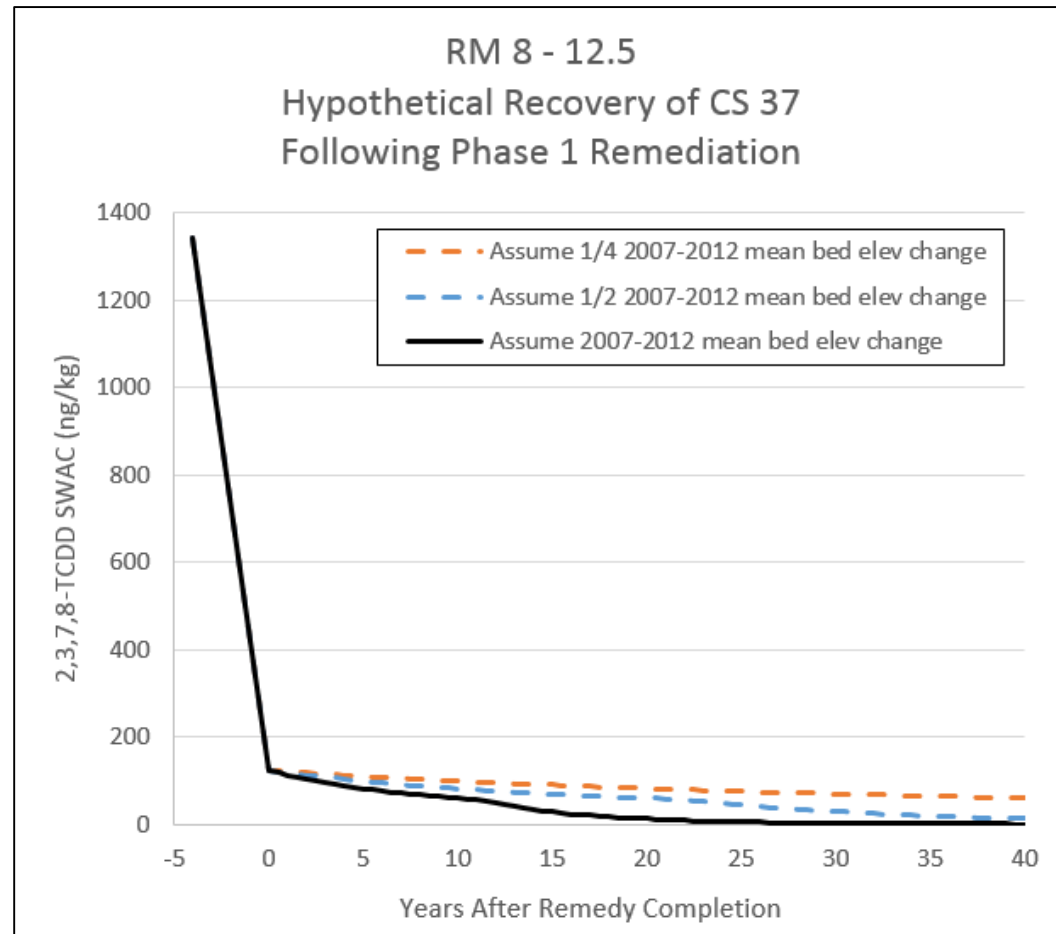


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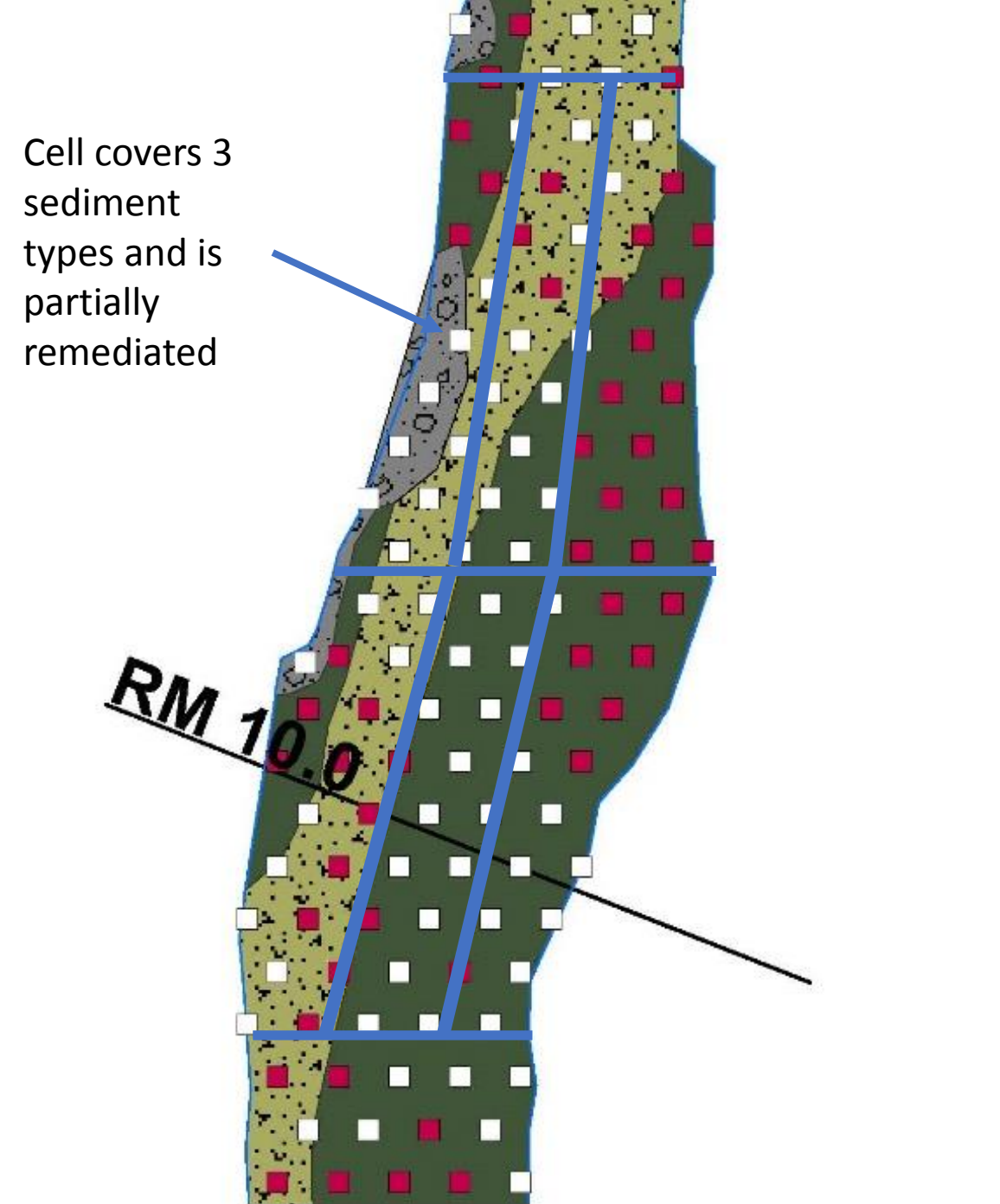


Impact of Initial Removal of Alternative RAL's					
RAL (ppt of dioxin)	CY Dredged (2.5' dredge)	% Reduction in SWAC	Post Remediation SWAC	Addresses Sediment Source	Dredge Recovering Areas
500	175,000	85	200	N	N
400	200,000	88	155	N	N
300	230,000	91	120	Y	N
200	290,000	94	80	Y	Y
100	400,000	97	40	Y	Y

Role and Use of Modeling in Upper 9-mile Plan

- Current Limitations of FFS & RI/FS Projections
 - Ability of the model to estimate the natural recovery component of the proposed plan compromised by:
 - Crude representation of the river
 - Each model grid cell covers a range of water depths, sediment types and depositional characteristics
 - Remediation occurs at scales smaller than the model
 - Lack of the data needed to calibrate the model's long-term behavior
 - Do not have a long term record of sediment concentrations
 - Grid cells estimated net erosion/deposition do not compare well with data

Illustration of Challenges
Grid Resolution Causes in
Representing Remediation



Role and Use of Modeling in Upper 9-mile Plan

- Use of Modeling in the Upper 9-Mile Plan (AQ)
 - Despite limitations, modeling is useful for examining recontamination
 - Updated model may be better for this than the ROD model because of enhancements
 - Model also useful to evaluate sequencing options for remediation
 - Preliminary results of the model suggest that upper 9 miles are impacting the lower 8 and it might be better to do the upper 9 first
- Model results may be useful to examine the portion of the model grid where deposition behavior is simulated well enough to have some confidence in recovery estimates

EPA Recognized the Limitations of Its FS Models for the Hudson River

- As stated in the Draft Five Year Review Report
 - The models, however, were not intended to predict the specific years in which specified PCB levels would be achieved in fish
 - Given the differences between ROD assumptions and implementation described above, quantitative comparisons of model results to observed data during and immediately after dredging are not directly comparable and therefore are not appropriate
 - It was also recognized at the time of the ROD that forecasts of fish tissue concentration become increasingly uncertain for the longer time periods needed to forecast time to achieve risk targets

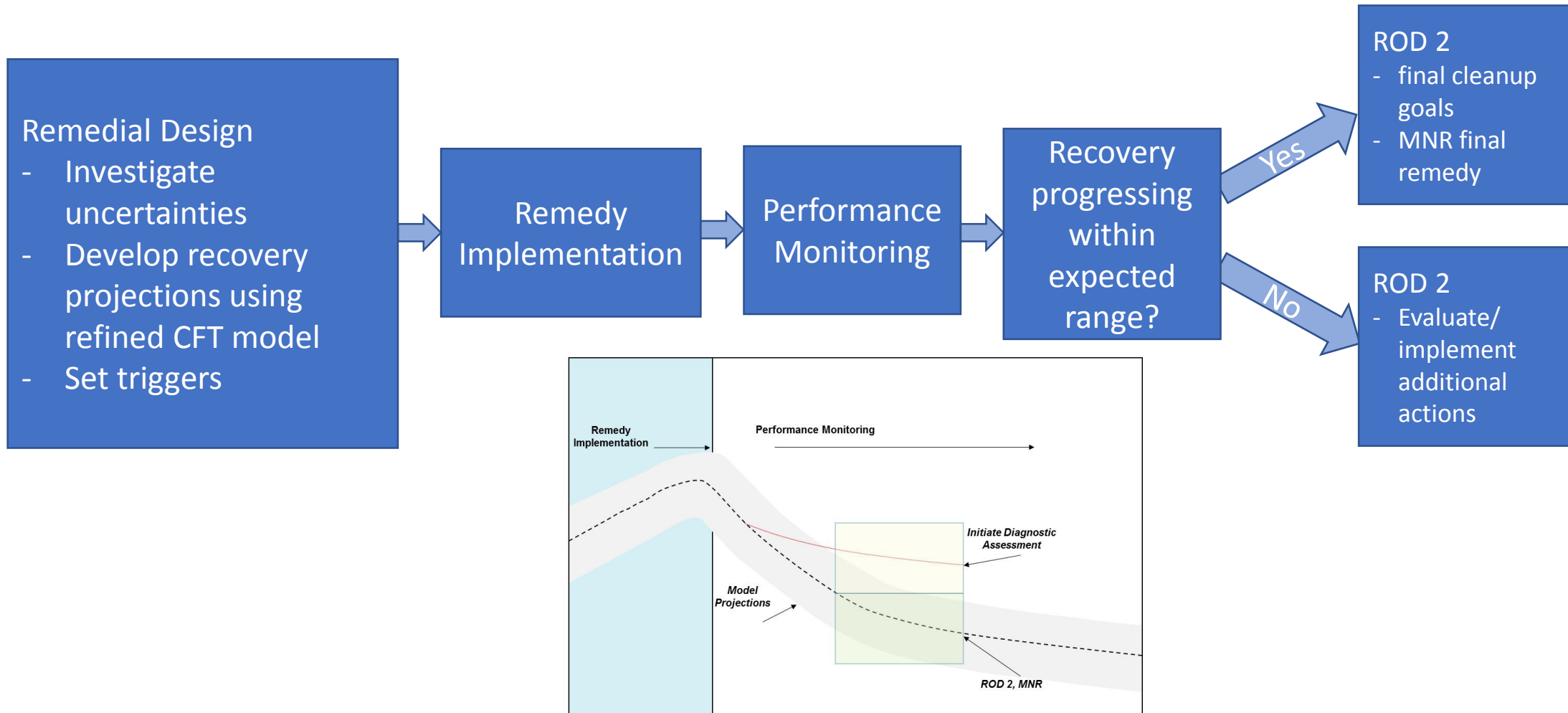
Bioaccumulation Peer Review

- Phase 1 Remedial Action will not include the identification of Remedial Goals
- Lack of contaminant trend data for CFT Model impacts the predictive power of the Bioaccumulation Model
- The relationship between the biota and sediment are not well represented by the use of a BSAF and are likely to result in a significant overestimate of the impact to the LPR Food Chain – thus identifying a larger than required Phase 1 Remedy
- Peer review of the Bioaccumulation Model is not a critical path Item for the Phase 1 Upper 9-mile Plan
- The Model's Framework is based on the Gobas Model one of several identified in EPA's 2006 MWP and has been used at several other sites
- Peer review could occur during the interval between the Final Phase 1 FS & RD

Upper 9-Mile RAOs

- **Human Health - Fish and Crab Consumption:** Reduce cancer risks and noncancer health hazards for people eating fish and crab by reducing the concentrations of COCs in the sediments and surface water of the Lower Passaic River.
- **Human Health - Direct Contact:** Reduce cancer risks and noncancer health hazards to people who come into direct contact with sediment by reducing concentrations of COCs in the sediments of the Lower Passaic River.
- **Ecological:** Reduce the risks to ecological receptors by reducing the concentrations of COCs in the sediments and surface water of the Lower Passaic River.
- **Contaminant Migration:** Reduce contaminant flux and recontamination potential to the lower 8 miles of the Lower Passaic River by reducing the migration of COC-contaminated sediments from the upper 9-mile reach.

Upper 9-mile Adaptive Management Process



Adaptive Management Plan Development

- Adaptive management plan will be developed in Remedial Design
- Expected tissue, water column, and sediment recovery rates will be developed using refined model projections
- Criteria and triggers established for diagnostic assessment and/or additional action will be based on comparison of performance monitoring data with projected recovery rates
- Diagnostic measures could include:
 - Increased monitoring frequency to confirm conditions of concern
 - Focused sampling to isolate area(s) of concern
 - Bathymetric evaluation
 - Model recalibration
 - CSM refinement
 - Source identification
- If the diagnostic assessment identifies:
 - Insufficient recovery with identifiable sources/causes – additional remedial actions will be evaluated/selected
 - Slower than projected but ongoing recovery – revisit CSM and/or model projections, re-evaluate acceptability of risk reduction timeframes, continue monitoring and/or consider additional actions

Remedial Action Monitoring Elements

- **Baseline monitoring**
 - Establish pre-dredge conditions for comparison with post-remediation conditions
- **Construction monitoring**
 - Evaluate physical and chemical water column parameters during construction to confirm BMPs
- **Performance monitoring**
 - Interim monitoring to evaluate short-term system response during remedy implementation
 - Long-term monitoring of system response to support adaptive management and 5-year reviews
- **Operation and Maintenance (O&M) monitoring**
 - Monitor cap integrity and performance over time

Anticipated Baseline and Long-Term Monitoring Components

- Biota
 - Species, tissue types, locations, and frequencies TBD
- Water column
 - COC and solids concentrations entering, within, and exiting the upper 9 miles
- Sediment Recovery Indicator Areas (RIAs)
 - Inside and outside of remediated areas
 - Range of sedimentation regimes
- Bathymetry

Preliminary Metrics, Triggers, and Responses

Remedy Objective/ Performance Standard	Primary Monitoring Metrics	Conceptual Triggers	Response Actions
RAO 1: Reduce risks to people who consume fish and crab	<ul style="list-style-type: none"> • Baseline and long-term monitoring • Tissue, water column, and sediment 	<ul style="list-style-type: none"> • Tissue recovery rates are slower than the projected range • Tissue concentrations reach a plateau that will not achieve adequate risk reduction 	<ul style="list-style-type: none"> • Confirmation tissue sampling • Diagnostic sediment and water column monitoring • Source investigation • Model recalibration • Evaluation/selection of additional source control or in-water actions
Remedy Performance Standard: Prevent re-exposure of subsurface sediments with COC concentrations >> RALs in uncapped areas	<ul style="list-style-type: none"> • Baseline and post-construction bathymetry • Future bathymetric surveys in response to high-flow events 	<ul style="list-style-type: none"> • Bathymetry data indicate erosion and re-exposure of buried contamination 	<ul style="list-style-type: none"> • Sediment sampling in potentially eroded/exposed areas • Evaluation/selection of additional actions

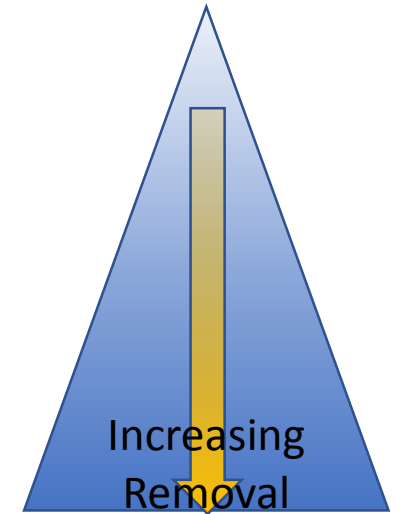
Adaptive management metrics and triggers are not proposed for RAOs 2, 3, and 4 as these RAOs are expected to be met at construction completion.

General Options for Expanding the Set of Remedial Alternatives

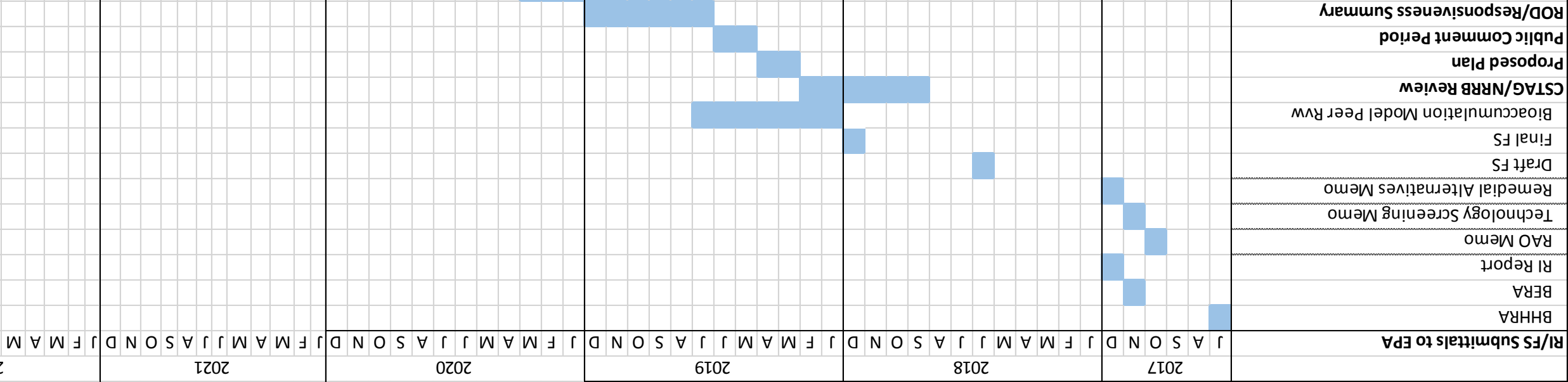
- Alternative dredge depths and cap designs
- Technology assignments for constrained areas (e.g., adjacent to near-shore or in-water structures, utility corridors)
 - MNR
 - ENR/In-situ treatment
 - Reactive cap
 - Setbacks
- Processing, transport, and disposal options

Preliminary Set of Remedial Alternatives

- Alternative 1 – No further action
- Alternative 2 – Partial dredge and reactive cap
 - Dredging within remedial footprint, dredge depths ~1-2 feet
- Alternative 3 – Partial dredge and conventional cap
 - Dredging within remedial footprint, dredge depths ~2-3 feet
- For all active remedial alternatives:
 - Remedial footprint defined by RALs of 300 ppt for 2,3,7,8-TCDD and 1 ppm for PCBs
 - Alternative cap designs may be considered based on sediment stability and habitat criteria
 - MNR, ENR, and alternative cap designs may be evaluated for constrained areas and rocky shorelines



Upper 9-mile Plan – RI/FS Schedule



FS Technical Memoranda Schedule

- Overarching upper 9-mile FS schedule assumptions:
 - EPA/CPG agree on the plan presented in the 7/14/17 summary
 - EPA/PA comments on the memos will be incorporated into the FS, rather than a second round of memo revisions

Memo	Task	Date
RAO Memo	Call w/EPA to: <ul style="list-style-type: none">• Confirm RAOs• Confirm postponement of PRGs (scope revision)• Resolve any outstanding comments on Rev. 0	October 2 (week of)
	Revised memo to EPA	October 20*

*Or two weeks following EPA approval of scope

FS Technical Memoranda Schedule

Memo	Task	Date
Screening Memo	Call w/EPA to: <ul style="list-style-type: none"> • Confirm revised scope to focus on technology screening for the upper 9 miles • Confirm revised scope to exclude alternatives screening • Resolve any outstanding comments on Rev. 0 	October 9 (week of)
	Revised memo to EPA	November 3*
Alternatives Memo	Meeting w/EPA to: <ul style="list-style-type: none"> • Discuss set of alternatives • Confirm revised scope to include technical basis for alternatives, but exclude alternatives evaluation • Resolve any additional comments on Rev. 0 	October 30 (week of)
	Follow-up call or meeting w/EPA to: <ul style="list-style-type: none"> • Confirm set of alternatives 	November 13 (week of)
	Revised memo to EPA	December 22**

*Or three weeks following EPA approval of scope

**Or five weeks following EPA approval of scope

The Proposed Adaptive Remedy is Scientifically Supported and Certain to be Protective

Certain:

- Immediately reduces contaminant levels by an order of magnitude
- Human Health & Ecological risks significantly & quickly reduced
- Recovery will be accelerated

Expected:

- Meeting risk based cleanup goals between 20 and 50 years.

Certain:

- Post remediation monitoring will provide data needed to confirm recovery
- If additional remediation is needed more will be done

Next Steps

- CPG is prepared to pursue the Upper 9-Mile Plan including:
 - Completing the 17-mile RI this year
 - Refocusing the FS on the Upper 9-mile and accelerate completion of the FS in 2018
 - Pursuing a Phased Remedial Approach for the Upper 9-miles
 - Developing cooperatively with EPA an Adaptive Management Plan including:
 - Identifying potential criteria and triggers
 - Baseline and Long-Term Monitoring
 - Potential Recovery
 - Follow-on Activities
 - Using modeling to address specific questions when the models can provide useful and meaningful information for decision-making in the FS, RD and RA for the Upper 9-Mile Plan
- Is EPA prepared to commit to the Upper 9-Mile Plan?